



# SUBSTITUTE SEQUENCE LISTING

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<110> Lauber, E.  
Guilley, Hubert  
Richards, Ken  
Jonard, Gerard

<120> METHOD OF GENETIC MODIFICATION OF A WILD  
TYPE VIRAL SEQUENCE

<130> VANM190.001APC

<140> US 09/743,905

<141> 2001-04-24

<150> EP 98870159.5

<151> 1998-07-10

<150> PCT BE99/00089

<151> 1999-07-09

<160> 8

<170> FastSEQ for Windows Version 4.0

<210> 1

<211> 399

<212> DNA

<213> Artificial Sequence

<220>

<223> genetically modified TGB-3 viral sequence

<221> CDS

<222> (1)...(399)

<400> 1

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| atg | gtg | ctt | gtg | gtt | gca | gta | gct | tta | tct | aat | att | gta | ttg | tac | ata | 48 |
| Met | Val | Leu | Val | Val | Ala | Val | Ala | Leu | Ser | Asn | Ile | Val | Leu | Tyr | Ile |    |
| 1   |     |     | 5   |     |     |     |     | 10  |     |     |     |     | 15  |     |     |    |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |    |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|
| gtt | gcc | ggt | tgt | gtt | gtt | gtc | agt | atg | ttg | tac | tca | ccg | ttt | ttc | agc | 96 |
| Val | Ala | Gly | Cys | Val | Val | Val | Ser | Met | Leu | Tyr | Ser | Pro | Phe | Phe | Ser |    |
|     |     | 20  |     |     |     |     | 25  |     |     |     |     | 30  |     |     |     |    |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| aac | gat | gtt | aaa | gcg | tcc | agc | tat | gcg | gga | gca | att | ttt | aag | ggg | agc | 144 |
| Asn | Asp | Val | Lys | Ala | Ser | Ser | Tyr | Ala | Gly | Ala | Ile | Phe | Lys | Gly | Ser |     |
|     |     | 35  |     |     |     |     | 40  |     |     |     | 45  |     |     |     |     |     |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| ggc | tgt | atc | atg | gac | agg | aat | tcg | ttt | gct | caa | ttt | ggg | agt | tgc | gat | 192 |
| Gly | Cys | Ile | Met | Asp | Arg | Asn | Ser | Phe | Ala | Gln | Phe | Gly | Ser | Cys | Asp |     |
|     | 50  |     |     |     |     | 55  |     |     |     | 60  |     |     |     |     |     |     |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| att | cca | aag | cat | gta | gcc | gag | tcc | atc | act | aag | gtt | gcc | acc | aaa | gag | 240 |
| Ile | Pro | Lys | His | Val | Ala | Glu | Ser | Ile | Thr | Lys | Val | Ala | Thr | Lys | Glu |     |
| 65  |     |     |     |     | 70  |     |     |     |     | 75  |     |     |     |     | 80  |     |

|   |     |
|---|-----|
| cac gat gtt gac ata atg gta aaa agg ggt gaa gtg acc gtt cgt gtt | 288 |
| His Asp Val Asp Ile Met Val Lys Arg Gly Glu Val Thr Val Arg Val |     |
| 85 90 95  |     |
|   |     |
| gtg act ctc acc gaa act att ttt ata ata tta tct aga ttg ttt ggt | 336 |
| Val Thr Leu Thr Glu Thr Ile Phe Ile Ile Leu Ser Arg Leu Phe Gly |     |
| 100 105 110   |     |
|   |     |
| ttg gcg gtg ttt ttg ttc atg ata tgt tta atg tct ata gtt tgg ttt | 384 |
| Leu Ala Val Phe Leu Phe Met Ile Cys Leu Met Ser Ile Val Trp Phe |     |
| 115 120 125   |     |
|   |     |
| tgg tat cat aga taa   | 399 |
| Trp Tyr His Arg *   |     |
| 130   |     |

<210> 2  
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 <213> Artificial Sequence

<220>  
 <223> genetically modified TGB-3 viral sequence

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|---|
| <400> 2   |
| Met Val Leu Val Val Ala Val Ala Leu Ser Asn Ile Val Leu Tyr Ile |
| 1 5 10 15   |
| Val Ala Gly Cys Val Val Val Ser Met Leu Tyr Ser Pro Phe Phe Ser |
| 20 25 30  |
| Asn Asp Val Lys Ala Ser Ser Tyr Ala Gly Ala Ile Phe Lys Gly Ser |
| 35 40 45  |
| Gly Cys Ile Met Asp Arg Asn Ser Phe Ala Gln Phe Gly Ser Cys Asp |
| 50 55 60  |
| Ile Pro Lys His Val Ala Glu Ser Ile Thr Lys Val Ala Thr Lys Glu |
| 65 70 75 80   |
| His Asp Val Asp Ile Met Val Lys Arg Gly Glu Val Thr Val Arg Val |
| 85 90 95  |
| Val Thr Leu Thr Glu Thr Ile Phe Ile Ile Leu Ser Arg Leu Phe Gly |
| 100 105 110   |
| Leu Ala Val Phe Leu Phe Met Ile Cys Leu Met Ser Ile Val Trp Phe |
| 115 120 125   |
| Trp Tyr His Arg   |
| 130   |

<210> 3  
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<220>  
 <223> genetically modified TGB-3 viral sequence

<221> CDS  
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atg gtg ctt gtg gtt aaa gta gat tta tct aat att gta ttg tac ata 48
Met Val Leu Val Val Lys Val Asp Leu Ser Asn Ile Val Leu Tyr Ile
1 5 10 15

gtt gcc ggt tgt gtt gtt gtc agt atg ttg tac tca ccg ttt ttc agc 96
Val Ala Gly Cys Val Val Val Ser Met Leu Tyr Ser Pro Phe Phe Ser
20 25 30

aac gat gtt aaa gcg tcc agc tat gcg gga gca att ttt aag ggg agc 144
Asn Asp Val Lys Ala Ser Ser Tyr Ala Gly Ala Ile Phe Lys Gly Ser
35 40 45

ggc tgt atc atg gcc gcg aat tcg ttt gct caa ttt ggg agt tgc gat 192
Gly Cys Ile Met Ala Ala Asn Ser Phe Ala Gln Phe Gly Ser Cys Asp
50 55 60

att cca aag cat gta gcc gag tcc atc act aag gtt gcc acc aaa gag 240
Ile Pro Lys His Val Ala Glu Ser Ile Thr Lys Val Ala Thr Lys Glu
65 70 75 80

cac gat gtt gac ata atg gta aaa agg ggt gaa gtg acc gtt cgt gtt 288
His Asp Val Asp Ile Met Val Lys Arg Gly Glu Val Thr Val Arg Val
85 90 95

gtg act ctc acc gaa act att ttt ata ata tta tct aga ttg ttt ggt 336
Val Thr Leu Thr Glu Thr Ile Phe Ile Ile Leu Ser Arg Leu Phe Gly
100 105 110

ttg gcg gtg ttt ttg ttc atg ata tgt tta atg tct ata gtt tgg ttt 384
Leu Ala Val Phe Leu Phe Met Ile Cys Leu Met Ser Ile Val Trp Phe
115 120 125

tgg tat cat aga taa 399
Trp Tyr His Arg *
130

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<210> 4
<211> 132
<212> PRT
<213> Artificial Sequence

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<220>
<223> genetically modified TGB-3 viral sequence

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<400> 4
Met Val Leu Val Val Lys Val Asp Leu Ser Asn Ile Val Leu Tyr Ile
1 5 10 15
Val Ala Gly Cys Val Val Val Ser Met Leu Tyr Ser Pro Phe Phe Ser
20 25 30
Asn Asp Val Lys Ala Ser Ser Tyr Ala Gly Ala Ile Phe Lys Gly Ser
35 40 45
Gly Cys Ile Met Ala Ala Asn Ser Phe Ala Gln Phe Gly Ser Cys Asp
50 55 60
Ile Pro Lys His Val Ala Glu Ser Ile Thr Lys Val Ala Thr Lys Glu

```

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 65  |     |     |     | 70  |     |     |     |     | 75  |     |     |     | 80  |
| His | Asp | Val | Asp | Ile | Met | Val | Lys | Arg | Gly | Glu | Val | Thr | Val |
|     |     |     |     | 85  |     |     |     |     | 90  |     |     |     | 95  |
| Val | Thr | Leu | Thr | Glu | Thr | Ile | Phe | Ile | Ile | Leu | Ser | Arg | Leu |
|     |     |     |     | 100 |     |     |     | 105 |     |     |     |     | 110 |
| Leu | Ala | Val | Phe | Leu | Phe | Met | Ile | Cys | Leu | Met | Ser | Ile | Val |
|     |     |     |     | 115 |     |     | 120 |     |     |     |     | 125 |     |
| Trp | Tyr | His | Arg |     |     |     |     |     |     |     |     |     |     |
|     | 130 |     |     |     |     |     |     |     |     |     |     |     |     |

<210> 5

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<213> Artificial Sequence

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<223> genetically modified TGB-3 viral sequence

<221> CDS

<222> (1)...(399)

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|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|
| atg | gtg | ctt | gtg | ggt | aaa | gta | gat | tta | tct | aat | att | gta | ttg | tac | ata | 48 |
| Met | Val | Leu | Val | Val | Lys | Val | Asp | Leu | Ser | Asn | Ile | Val | Leu | Tyr | Ile |    |
| 1   |     |     |     | 5   |     |     |     |     | 10  |     |     |     |     | 15  |     |    |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |    |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|
| ggt | gcc | ggt | tgt | ggt | ggt | gtc | agt | atg | ttg | tac | tca | ccg | ttt | ttc | agc | 96 |
| Val | Ala | Gly | Cys | Val | Val | Val | Ser | Met | Leu | Tyr | Ser | Pro | Phe | Phe | Ser |    |
|     |     |     | 20  |     |     |     |     | 25  |     |     |     |     | 30  |     |     |    |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| aac | gat | ggt | aaa | gcg | tcc | agc | tat | gcg | gga | gca | att | ttt | aag | ggg | agc | 144 |
| Asn | Asp | Val | Lys | Ala | Ser | Ser | Tyr | Ala | Gly | Ala | Ile | Phe | Lys | Gly | Ser |     |
|     |     | 35  |     |     |     |     | 40  |     |     |     |     | 45  |     |     |     |     |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| ggc | tgt | atc | atg | gac | agg | aat | tcg | ttt | gct | caa | ttt | ggg | agt | tgc | gat | 192 |
| Gly | Cys | Ile | Met | Asp | Arg | Asn | Ser | Phe | Ala | Gln | Phe | Gly | Ser | Cys | Asp |     |
|     | 50  |     |     |     |     | 55  |     |     |     |     | 60  |     |     |     |     |     |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| att | cca | aag | cat | gta | gcc | gag | tcc | atc | act | aag | ggt | gcc | acc | aaa | gag | 240 |
| Ile | Pro | Lys | His | Val | Ala | Glu | Ser | Ile | Thr | Lys | Val | Ala | Thr | Lys | Glu |     |
|     | 65  |     |     |     | 70  |     |     |     | 75  |     |     |     |     |     | 80  |     |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| cac | gat | ggt | gac | ata | atg | gta | aaa | agg | ggt | gaa | gtg | acc | ggt | cgt | ggt | 288 |
| His | Asp | Val | Asp | Ile | Met | Val | Lys | Arg | Gly | Glu | Val | Thr | Val | Arg | Val |     |
|     |     |     |     | 85  |     |     |     |     | 90  |     |     |     |     | 95  |     |     |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| gtg | act | ctc | acc | gaa | act | att | ttt | ata | ata | tta | tct | aga | ttg | ttt | ggt | 336 |
| Val | Thr | Leu | Thr | Glu | Thr | Ile | Phe | Ile | Ile | Leu | Ser | Arg | Leu | Phe | Gly |     |
|     |     |     | 100 |     |     |     |     | 105 |     |     |     |     | 110 |     |     |     |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| ttg | gat | gat | ttt | ttg | ttc | atg | ata | tgt | tta | atg | tct | ata | ggt | tgg | ttt | 384 |
| Leu | Asp | Asp | Phe | Leu | Phe | Met | Ile | Cys | Leu | Met | Ser | Ile | Val | Trp | Phe |     |
|     |     |     | 115 |     |     |     | 120 |     |     |     |     | 125 |     |     |     |     |

|     |     |     |     |     |  |  |  |  |  |  |  |  |  |  |  |     |
|-----|-----|-----|-----|-----|--|--|--|--|--|--|--|--|--|--|--|-----|
| tgg | tat | cat | aga | taa |  |  |  |  |  |  |  |  |  |  |  | 399 |
| Trp | Tyr | His | Arg | *   |  |  |  |  |  |  |  |  |  |  |  |     |

130

<210> 6

<211> 132

<212> PRT

<213> Artificial Sequence

<220>

<223> genetically modified TGB-3 viral sequence

<400> 6

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|
| Met | Val | Leu | Val | Val | Lys | Val | Asp | Leu | Ser | Asn | Ile | Val | Leu | Tyr | Ile |  |
| 1   |     |     |     | 5   |     |     |     | 10  |     |     |     |     | 15  |     |     |  |
| Val | Ala | Gly | Cys | Val | Val | Val | Ser | Met | Leu | Tyr | Ser | Pro | Phe | Phe | Ser |  |
|     |     | 20  |     |     |     |     | 25  |     |     |     |     | 30  |     |     |     |  |
| Asn | Asp | Val | Lys | Ala | Ser | Ser | Tyr | Ala | Gly | Ala | Ile | Phe | Lys | Gly | Ser |  |
|     |     | 35  |     |     |     |     | 40  |     |     |     |     | 45  |     |     |     |  |
| Gly | Cys | Ile | Met | Asp | Arg | Asn | Ser | Phe | Ala | Gln | Phe | Gly | Ser | Cys | Asp |  |
|     | 50  |     |     |     |     | 55  |     |     |     |     | 60  |     |     |     |     |  |
| Ile | Pro | Lys | His | Val | Ala | Glu | Ser | Ile | Thr | Lys | Val | Ala | Thr | Lys | Glu |  |
| 65  |     |     |     | 70  |     |     |     | 75  |     |     |     |     |     | 80  |     |  |
| His | Asp | Val | Asp | Ile | Met | Val | Lys | Arg | Gly | Glu | Val | Thr | Val | Arg | Val |  |
|     |     |     |     | 85  |     |     |     | 90  |     |     |     |     |     | 95  |     |  |
| Val | Thr | Leu | Thr | Glu | Thr | Ile | Phe | Ile | Ile | Leu | Ser | Arg | Leu | Phe | Gly |  |
|     |     |     | 100 |     |     |     |     | 105 |     |     |     |     | 110 |     |     |  |
| Leu | Asp | Asp | Phe | Leu | Phe | Met | Ile | Cys | Leu | Met | Ser | Ile | Val | Trp | Phe |  |
|     |     | 115 |     |     |     |     | 120 |     |     |     |     | 125 |     |     |     |  |
| Trp | Tyr | His | Arg |     |     |     |     |     |     |     |     |     |     |     |     |  |
|     | 130 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |

<210> 7

<211> 399

<212> DNA

<213> Beet Necrotic Yellow Vein Virus

<220>

<223> Nucleotide sequence of BNYVV RNA-2 encoding P15 protein

<221> CDS

<222> (1)...(399)

<400> 7

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| atg | gtg | ctt | gtg | gtt | aaa | gta | gat | tta | tct | aau | att | gta | ttg | tac | ata | 48  |
| Met | Val | Leu | Val | Val | Lys | Val | Asp | Leu | Ser | Asn | Ile | Val | Leu | Tyr | Ile |     |
| 1   |     |     |     | 5   |     |     |     | 10  |     |     |     |     | 15  |     |     |     |
| gtt | gcc | ggt | tgt | gtt | gtt | gtc | agt | atg | ttg | tac | tca | ccc | ttt | ttc | agc | 96  |
| Val | Ala | Gly | Cys | Val | Val | Val | Ser | Met | Leu | Tyr | Ser | Pro | Phe | Phe | Ser |     |
|     |     | 20  |     |     |     |     | 25  |     |     |     |     | 30  |     |     |     |     |
| aac | gat | gtt | aaa | gcg | tcc | agc | tat | gcg | gga | gca | att | ttt | aag | ggg | agc | 144 |
| Asn | Asp | Val | Lys | Ala | Ser | Ser | Tyr | Ala | Gly | Ala | Ile | Phe | Lys | Gly | Ser |     |
|     |     | 35  |     |     |     |     | 40  |     |     |     |     | 45  |     |     |     |     |

|   |     |
|---|-----|
| ggc tgt atc atg gac agg aat tcg ttt gct caa ttt ggg agt tgc gat | 192 |
| Gly Cys Ile Met Asp Arg Asn Ser Phe Ala Gln Phe Gly Ser Cys Asp |     |
| 50 55 60  |     |
|   |     |
| att cca aag cat gta gcc gag tcc atc act aag gtt gcc acc aaa gag | 240 |
| Ile Pro Lys His Val Ala Glu Ser Ile Thr Lys Val Ala Thr Lys Glu |     |
| 65 70 75 80   |     |
|   |     |
| cac gat gtt gac ata atg gta aaa agg ggt gaa gtc acc gtt cgt gtt | 288 |
| His Asp Val Asp Ile Met Val Lys Arg Gly Glu Val Thr Val Arg Val |     |
| 85 90 95  |     |
|   |     |
| gtg act ctc acc gaa act att ttt ata ata tta tct aga ttg ttt ggt | 336 |
| Val Thr Leu Thr Glu Thr Ile Phe Ile Ile Leu Ser Arg Leu Phe Gly |     |
| 100 105 110   |     |
|   |     |
| ttg gcg gtg ttt ttg ttc atg ata tgt tta atg tct ata gtt tgg ttt | 384 |
| Leu Ala Val Phe Leu Phe Met Ile Cys Leu Met Ser Ile Val Trp Phe |     |
| 115 120 125   |     |
|   |     |
| tgg tat cat aga taa   | 399 |
| Trp Tyr His Arg *   |     |
| 130   |     |

<210> 8

<211> 132

<212> PRT

<213> Beet Necrotic Yellow Vein Virus

<220>

<223> Protein encoded by SEQ ID NO:7

<400> 8

|   |  |
|---|--|
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| 1 5 10 15   |  |
| Val Ala Gly Cys Val Val Val Ser Met Leu Tyr Ser Pro Phe Phe Ser |  |
| 20 25 30  |  |
| Asn Asp Val Lys Ala Ser Ser Tyr Ala Gly Ala Ile Phe Lys Gly Ser |  |
| 35 40 45  |  |
| Gly Cys Ile Met Asp Arg Asn Ser Phe Ala Gln Phe Gly Ser Cys Asp |  |
| 50 55 60  |  |
| Ile Pro Lys His Val Ala Glu Ser Ile Thr Lys Val Ala Thr Lys Glu |  |
| 65 70 75 80   |  |
| His Asp Val Asp Ile Met Val Lys Arg Gly Glu Val Thr Val Arg Val |  |
| 85 90 95  |  |
| Val Thr Leu Thr Glu Thr Ile Phe Ile Ile Leu Ser Arg Leu Phe Gly |  |
| 100 105 110   |  |
| Leu Ala Val Phe Leu Phe Met Ile Cys Leu Met Ser Ile Val Trp Phe |  |
| 115 120 125   |  |
| Trp Tyr His Arg   |  |
| 130   |  |